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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/561,712

06/07/2007

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EXAMINER

SASTRI, SATYA B

ART UNIT

PAPER NUMBER

1796

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/561,712	Applicant(s) TOUR ET AL.	
	Examiner SATYA B. SASTRI	Art Unit 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-68 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 54-68 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-68 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 June 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/16/07</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This office action is in response to application filed on 6/7/07. Claims 1-68 are now pending in the application.

Restriction Requirement

2. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claims 1-24, drawn to a method of making CNT-elastomer composite, using elastomeric precursor and carbon nanotubes,

Group II, claims 25-40, drawn to a method of making surfactant wrapped CNT-elastomer composite,

Group III, claims 41-53, drawn to a method of making CNT-elastomer composite by using a solvent,

Group IV, claims 54-68, drawn to a CNT-elastomer composite.

3. The inventions listed as Groups I and IV do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical feature for the following reason: The Groups of

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inventions I and IV have different objectives in that Groups I-III inventions correspond to a method of making the composite from elastomeric precursor and functionalized nanotubes, with or without surfactant or dispersing medium . Group IV invention does not necessarily require any of the methods of Group I-III. For instance, Tour et al. (WO 02/060812, cited as X-reference in the international search report and considered equivalent of US 7,250,147 B2) discloses a composite material comprising a polymer that includes carbon nanotubes and formed by derivatizing the carbon nanotubes with functional groups that is capable of polymerizing or initiating a polymerization. Once the functional group is attached, standard polymerization procedures may be employed to form the composite in situ (col. 20, lines 22-41). Thus, there is no special technical feature which could provide unity of invention for the inventive groups.

4. During a telephone conversation with Mr. Tom Thrash on 7/13/09, a provisional election was made without traverse to prosecute the invention of Group IV, claims 54-68. Affirmation of this election must be made by applicant in replying to this Office action.

Claim Objections

5. Claims 55 and 58 are objected to for the following reasons:

In claim 55, the phrase “that of” should be inserted after the phrase “greater than”. Additionally, since the scope of claim 55 is further limited in claim 56 with regard to strain at break, examiner construes claim 55 to recite the limitations pertaining to tensile modulus and strain-at-break to be in the alternative form.

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In claim 58, the basis of wt.% should be recited as based on the total wt. of the composite.

Appropriate correction is required.

Claim Rejections - 35 USC § 102 and 103

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 54, 58, 64 are rejected under 35 U.S.C. 102(a) as being anticipated by Tobita et al. (US 2003/0096104 A1, cited as X-reference in the International Search Report).

Tobita et al. disclose complex molded body of carbon nanotubes in a matrix of at least one organic polymer selected from the group consisting of thermoplastic resins, thermosetting resins, rubber and thermoplastic elastomers (ab.).

Disclosed elastomers and rubbers include butadiene rubbers, isoprene rubber, chloroprene rubber, silicone rubber etc. (0025). The carbon nanotubes may be used in

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amounts of 0.01 to 100 parts by wt. relative to 100 parts by wt. of the matrix. Effective anisotropic function is achieved with 0.1 to 20 parts by wt. of nanotubes (0030).

Furthermore, to improve the wettability or adhesion of the nanotubes to the matrix resin, the surface of the carbon nanotubes is preferably pretreated with degassing, washing or activation process such as UV radiation, corona discharge or plasma treatments. In addition, after surface treatment, the surface can be treated with a coupling agent such as a silane-containing agent or a titanium-containing agent (0031). Given that such treatments with coupling agents result in functionalization of the carbon nanotubes, presently cited claims are anticipated by the prior art.

With regard to claim 64, the prior art discloses that a polymeric alloy comprising a polymer in combination with additives such as plasticizers, a stabilizer, a surfactant or a colorant may be used.

9. Claims 55-57, 67 are rejected under 35 U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tobita et al. (US 2003/0096104 A1).

The discussion with regard to Tobita et al. above in paragraph 8 is incorporated herein by reference.

Given that the compositional requirements as presently claimed are met by Tobita et al., the presently recited properties must be inherent to the composition. Case law holds that a material and its properties are inseparable. *In re Spada*, 911 F.2d 705,709, 15 USPQ2d 1655, 1658 (Fed. Cir. '1990).

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In the alternative, it would have been obvious to one of ordinary skill in the art that the presently cited properties would necessarily be present once the Tobita et al. product is provided, absent evidence to the contrary.

10. Claim 68 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tobita et al. (US 2003/0096104 A1).

The discussion with regard to Tobita et al. above in paragraph 8 is incorporated herein by reference.

The prior art fails to disclose composites comprising presently claimed amount of crosslinking agent.

The amount of crosslinking agent is a result effective variable because changing the amount of the agent will clearly affect the degree of crosslinking and the properties. See MPEP § 2144.05 (B). Case law holds that “discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.” See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Thus, it would have been obvious to one of ordinary skill in the appropriately effective amounts of crosslinking agent, including those within the presently claimed range and thereby arrive at the present invention.

11. Claims 59-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobita et al. (US 2003/0096104 A1) in view of Bahr et al. (J. Mater. Chem., 2002, Vol. 12, 1952-1958, Cited in the IDS dated 11/16/07).

The discussion with regard to Tobita et al. above in paragraph 8 is incorporated herein by reference.

Secondary reference to Bahr et al. discloses modification of single wall carbon nanotube sidewalls and ends through oxidative reactions. Functional groups introduced via such functionalization improve solubility and ease of dispersion due to chemical attachment to surfaces and polymer matrices (page 1952, paragraphs 1-2, page 1953 col. 2). Given the teaching of improved dispersion properties, it would have been obvious to one of ordinary skill in the art to functionalize single-wall carbon nanotubes of Tobita et al. as taught by Bahr et al. and thereby arrive at the presently cited claims.

With regard to claim 62, the polar functional groups on the carbon surface are capable of acid base type interactions with the matrix polymer.

12. Claims 54, 59, 60, 61, 62, 65, 66, 67 are rejected under 35 U.S.C. 102(a) as being anticipated by Tour et al. (WO 02/060812, cited as X-reference in the International Search Report).

At the outset, it is noted that WO 02/060812 is used for date purposes while US 7,250,147 B2 is used as the equivalent in the rejection set forth below.

Tour et al. disclose derivatizing carbon nanotubes, especially the side walls and end caps of single wall carbon nanotubes (col. 2, lines 50-55). The composite material may be made with chemically modified nanotubes and elastomers (col. 17, lines 20-35). When modified with suitable chemical groups, the nanotubes are compatible with the polymer matrix allowing transfer of the properties of the nanotubes to the properties of the composite material as a whole (col. 3, lines 49-59). The composites exhibit superior mechanical and conductive properties (col. 19, lines 20-25).

In light of above, present invention is anticipated by the prior art.

13. Claims 55-57 are rejected under 35 U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tour et al. (WO 02/060812).

The discussion with regard to Tour et al. above in paragraph 12 is incorporated herein by reference.

Given that the compositional requirements as presently claimed are met by Tour et al., the presently recited properties must be inherent to the composition. Case law holds that a material and its properties are inseparable. *In re Spada*, 911 F.2d 705,709, 15 USPQ2d 1655, 1658 (Fed. Cir. '1990).

In the alternative, it would have been obvious to one of ordinary skill in the art that the presently cited properties would necessarily be present once the Tour et al. product is provided, absent evidence to the contrary.

14. Claims 58 and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tour et al. (WO 02/060812).

The discussion with regard to Tour et al. above in paragraph 12 is incorporated herein by reference. Working examples in Table 3 disclose composites comprising nanotubes within the presently claimed range.

The prior art fails to disclose composites comprising (a) presently claimed amount of functionalized nanotubes and (b) crosslinking agent.

The amount of functionalized nanotubes and crosslinking agent for the elastomer are both result effective variables because changing their amount will clearly affect the extent of mechanical and/or conductive property enhancement and degree of

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crosslinking, respectively. See MPEP § 2144.05 (B). Case law holds that “discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.” See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Thus, it would have been obvious to one of ordinary skill in the appropriately effective amounts of functionalized nanotubes and crosslinking agent, including those within the presently claimed range and thereby arrive at the present invention.

15. Claims 63 and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tour et al. (WO 02/060812) in view of Tobita et al. (US 2003/0096104 A1

The discussion with regard to Tour et al. above in paragraph 12 is incorporated herein by reference.

The prior art fails to disclose composites comprising (a) presently claimed elastomeric matrix and (b) additive as presently claimed.

The discussion with regard to Tobita et al. above in paragraph 8 is incorporated herein by reference. Given that the primary reference to Tour et al. is open to the use of elastomers as matrix resin with carbon nanotubes and given that the secondary reference to Tobita et al. discloses butadiene rubbers, isoprene rubber, chloroprene rubber, silicone rubber as suitable matrix resins, it would have been obvious to one of ordinary skill in the art to utilize any of the art recognized elastomers including those that fall within the scope of present claim 63.

With regard to claim 64, the secondary reference discloses that a polymeric alloy comprising a polymer in combination with additives such as plasticizers, a stabilizer, a surfactant or a colorant may be used.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Satya Sastri at (571) 272 1112. The examiner can be reached on Mondays, Thursdays and Fridays, 7AM-5.30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. David Wu can be reached on 571-272-1114.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Satya B Sastri/

Examiner, Art Unit 1796